

1 BACKGROUND OF THE INVENTION: This application relates to a new
2 and improved headgear, and more specifically to a headgear or
3 helmet providing a lighting display for use by cyclists,
4 construction and underground workers, search and rescue persons,
5 emergency medical workers, firemen, police, meter readers, and so
6 forth. The lighting display may be used to define a forward
7 pathway or to illuminate objects, or to rearwardly signal a
8 wearer's presence. The lighting display comprises an LED array,
9 and is powered by a built-in, rechargeable battery through a
10 unique circuit which enables a long-term, suitably constant
11 output.

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13 Various types of protective helmets providing a lighting
14 displays are known in the prior art, and typical types of these
15 helmets are described in U.S. Patents 5,040,099; 5,327,587;
16 5,329,637; 5,357,409; 5,426,792; 5,479,325; 5,544,027; 5,485,358;
17 5,564,128; 5,570,946; 5,743,621; 5,758,947; 5,871,271; 6,007,213;
18 6,009,563; 6,113,244; 6,244,721; 6,328,454; 6,340,234; 6,464,369;
19 and, 6,497,493.

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21 However, none of the headgear in these patents disclose a
22 battery powered circuit for an LED array that produces a long
23 term, uniform illumination while providing a useful device for
24 its intended purpose. The headgear structure of this invention
25 may be a single, or a multi-component type, such as two or three.

1 BRIEF DESCRIPTION OF THE DRAWINGS:

2 FIG. 1 is an upper perspective view of the assembled
3 headgear of this invention;

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5 FIG. 2 is an exploded view of the upper and lower headgear
6 components of the invention and the LED array;

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8 FIG. 3 is a sectional side elevation view of the headgear
9 taken along lines 3 - 3 of FIG. 1;

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11 FIG. 4 is a circuit diagram of this invention for feeding
12 power from rechargeable batteries to the LED array; and,

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14 FIG. 5 shows the LED array connected to the rechargeable
15 batteries.

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17 DESCRIPTION OF THE PREFERRED EMBODIMENTS:

18 The headgear 10 of this invention is shown in FIGS. 1 - 3,
19 and comprises an upper helmet portion 11 defining an integrally
20 formed, outer central reinforcing ridge 12 and a corresponding
21 interior reinforcing grid area 13. Into the grid area 13 are
22 mounted removable or rechargeable lithium ion battery packs 14
23 and 15 which connect to a circuit board 16, the circuit itself
24 being shown in FIG. 4. Wire connections from the batteries to
25 the circuit board and to the LED arrays are shown in FIG. 5.

1 A rearwardly installed LED array 17 is mounted on the upper
2 helmet portion 11 and are connected to the circuit board and
3 driven by the battery packs. The LED array 17 is shielded by a
4 transparent acrylic sheet 18 mounted on the exterior of the upper
5 helmet 11. The front area of the upper helmet 11 is provided
6 with an enclosure 20 shielded by a curved, transparent acrylic
7 sheet 21 which protects an enclosed, front facing LED array 22.

8
9 An interfitting helmet portion 25 is configured to interlock
10 with the upper helmet portion 11, the two helmet portions being
11 secured together vertically by screws 26. The helmet portion 25
12 defines a flat portion 27 which registers with grid area 13 and
13 contacts the lower sides of the battery packs 14, 15 thereby
14 securing the battery packs in place. As indicated, the front
15 area of the helmet 25 defines the enclosure 20 into which the
16 front facing LED array 22 is mounted.

17
18 The LED array 22 is driven through the circuit board 16 from
19 the battery packs 14 and 15 as shown in FIG. 4, similarly to the
20 LED array 17 and the circuit of FIG. 4, which will be described,
21 infra. FIGS. 3 - 5 show an on-off switch 28 connected to the
22 circuit board 16 and circuit of this invention. FIG. 3 also
23 shows a charging outlet pin 29 for the battery packs 14 and 15,
24 the charging pin being adjacent to the on-off switch 28. The
25 batteries also may be removed for recharging or replacement.

1 An integrally formed, reinforcing wrap-around section 11a on
2 the helmet portion 11 defines bores 30 coinciding with bores (not
3 shown) in the helmet portion 25 through which pass screws 31
4 which horizontally secure the helmet portions 11 and 25 together.
5 The screws 26 and 31 thereby secure the helmet portions 11 and 25
6 both vertically and horizontally. If desired, an edge liner 25a
7 of injection molded polypropylene may be employed to engage the
8 edges between the helmet portions 11 and 25, and thereby effect
9 additional securement between the two helmets.

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11 As shown in FIG. 3, a protective foam head enclosure 32 such
12 as constructed from polyurethane or polystyrene foam is provided
13 to cushion the wearer's head from impact against the much harder
14 ABS plastic materials of both the helmet portions 11 and 25.
15 Similar bores (not shown) in the head enclosure 32 register with
16 the bores 30 and enable the helmet portions 11 and 25 and the
17 head enclosure to be secured together using the screws 31.

18

19 The circuit shown in FIGS. 4 and 5 enables a relatively long
20 and uniform battery power output before charging is required.
21 The lithium ion batteries JP1 and JP3 shown in FIGS. 4 and 5 each
22 deliver about 6600 milliamps at 7.2 volts and are isolated from
23 each other by a diode D2. When the on-off switch 28 (FIG. 3) is
24 turned on at JP1, the batteries JP1 and JP3 will turn on a
25 comparator such as an op amp comparator JP2, e.g. an LM358.

1 The comparator JP2 shows a direct coupled amplifier
2 configuration driven from the battery JP1 through transistors
3 PNP Q1 and NPN Q2, and through the coupling resistance R7 to the
4 input pin 1 of JP2. Resistances R1, R2, R3, R6/R4 respectively
5 will protect a Zener D1, Q1, R5-JP2 and LED arrays D2 (17, 22)
6 from excessive current/voltage.

7
8 Battery power from JP3 is applied to the voltage divider R5
9 and then to pin 2 of JP2, while pins 3, 4 of JP2 are both at
10 ground. Obviously, the op amp comparator JP2 is driven by both
11 batteries JP1 and JP3.

12
13 Capacitor C1 and resistance R8 are both grounded, and
14 provide ripple filtering, and R8 also shunts voltage from pin 3
15 of the JP2 to the Zener D1. JP2 (at pin 8) also drives the Zener
16 which functions as a shunt to maintain the load voltage constant
17 for changing current/voltage variations due to running down of
18 the batteries. In the reverse conduction condition as shown, the
19 Zener D1 also reduces ripple voltage.

20
21 When the switch 28 (FIG. 3) is turned on at JP1, and voltage
22 from the voltage divider R5 exceeds the pin 3 reference voltage,
23 the comparator JP2 (LM358) will turn on, and hence transistors Q1
24 and Q2 (driven from JP1 and JP3) will then turn on the LED arrays
25 D2 (17, 22).

1 Typically, the lumen output of the present device for about
2 93 LEDs is about 4000 MCD @ 20 milliamps for 5 - 5 1/2 hours
3 using 7.2 volt batteries. Moreover, the device of this invention
4 frees up the wearer's hands when viewing an operating field,
5 especially in an emergency situation.

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7 It will be appreciated that while a Zener diode is preferred
8 for use in the circuit described, other semiconductor devices
9 with similar turn-on characteristics may be utilized, and they
10 are described in the "SCR MANUAL, INCLUDING TRIACS AND OTHER
11 THYRISTORS" Sixth Edition, 1979 by General Electric, and
12 incorporated herein, by reference.

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14 Additionally, the circuit of this invention may be employed
15 for illuminating purposes other than in a helmet, such as an LED
16 array in a flashlight; to function as a traffic signal; as an LED
17 turn on device used with an alarm detection system; and so forth.